

43rd STUDENT CONFERENCE (E2)  
Educational Pico and Nano Satellites (4)

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DESIGN, IMPLEMENTATION, AND TESTING OF THE T-SAT1 NANOSATELLITE AT THE  
UNIVERSITY OF MANITOBA**Abstract**

From 2010-2012, the University of Manitoba (UofM) engaged in the design, implementation, and testing of a triple pico-satellite (T-Sat1) as part of the inaugural Canadian Satellite Design Challenge (CSDC). The competition expanded the understanding and skills learned in university courses through hands-on experiential learning. The UofM team consisted of more than 100 undergraduate and graduate students from Engineering, Science, Business, Architecture, and Art collaborating on various aspects of the satellite. The design philosophy embraced by the team was to design and build all subsystems at the university using off-the-shelf components, thus maximizing the opportunities for experiential learning. The team relied on the feedback provided throughout the project by more than 50 advisors from academia, industry, business, military, government, and the amateur radio community. The students in the project belong to the UofM Space Applications and Technology Society (UMSATS).

The T-Sat1 nanosatellite carried two scientific payloads. The primary payload monitored the behavior of tardigrades when exposed to the harsh space environment. The second experiment aimed to learn more about the Sun through spectroscopy. The spacecraft bus followed the standard 3U-Cubesat and contained all the necessary subsystems to support these payloads. For example, the Attitude Determination and Control unit used novel magnetic torque discs printed on circuit boards as actuators.

The students were also responsible for raising the necessary funds for the project and promoting it to the general public. More than 3,900 pre-university, university, and industry members were reached through various presentations and workshops in the two-year span of the project.

T-Sat1 received first place after completing the Preliminary Design Review and Critical Design Review in the CSDC, and finished with second place overall after Environmental Testing at the David Florida Labs of the Canadian Space Agency in September 2012. Although this spacecraft will not be launched, it is the first step in a longer-term goal of launching the first student-designed satellite from the UofM. A team of students has already commenced work on T-Sat2 and are building on the knowledge from the first iteration of the competition.

This paper summarizes the design, implementation, and testing of T-Sat1. As well, the paper describes the educational value of the competition highlighting both the technical and non-technical skills obtained by the members of the team.